

Rooted Apical Cutting (RAC) - A Novel Technology to Boost Potato Seed System

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SUMMARY

Potato (*Solanum tuberosum* L.) is a significant global food crop that provides both sustenance and industrial applications, contributing to income generation and livelihood improvement. However, the potato sector in India faces challenges in obtaining affordable, good-quality planting materials for small and marginal farmers in various potato-growing states. The cost of seed, which makes up a substantial portion (40-50%) of production expenses, is particularly burdensome for these farmers. As a result, some farmers resort to using discarded small-sized potatoes as seed in the potato-growing regions. To increase potato production and reduce costs, it is crucial to obtain high-quality, disease-free seed potato tubers at a lower cost. The use of apical rooted cutting (ARC) as a low-cost potato seed production method could address India's long-standing seed problem by decentralizing production and bringing it closer to the farming regions. ARC technology allows for economical production of high-quality seed material. By decentralizing potato seed production through this approach, the costs can be reduced by 25-50%. This will have a significant positive impact on potato yield and ultimately lead to greater profits for small and marginal farmers in potato-growing states..

INTRODUCTION

India is the second largest potato producer and consumer in the world. In India, potato seeds are produced in Punjab using seed plot technique and aeroponic technology and transported up to 2,000 km to potato growing states of India. However, the transportation of potato seeds from Punjab to potato-growing states in eastern and southern India is expensive and burdensome for poor farmers. The high seed prices have led some farmers to use low-quality seeds from previous harvests or from local markets, resulting in low yields due to seed-borne diseases. Even if farmers are willing to purchase high-quality seeds, there is no guarantee of timely delivery due to the long distances involved. This makes it difficult for small farmers to invest such a large amount in seed purchases, which make up almost half of the total production cost. However, if a low-cost technology for producing seed potatoes were made available, it could greatly increase potato production in these regions by improving productivity and reducing production costs. The eastern and southern regions of India are suitable for growing potato seed in both the Rabi season (October-March) and the Kharif season (July-October) in certain areas. A rooted apical cutting is a transplant produced in a screenhouse from tissue culture plants, which are disease-free and can be rapidly multiplied, are alternative to the current aeroponic seed production system. This technology should be promoted in potato production areas so that progressive farmers, farmer producer organizations, and other small entrepreneurs can adopt seed potato production and supply planting material to farmers in a timely manner.

Seed production in India

Addressing seed shortages for potato is a perennial challenge. In India, the multiplication rate of potato seed tubers is low, while the demand for seeds is high.

It is not possible to develop 100 % healthy seed stock from infected materials, which also adds to 40-50 % of cultivation costs. As an alternative to mini-tubers, apical cuttings are being considered in current production systems.

Rooted apical cuttings (RAC)

A cutting is a transplant produced in a screen house from tissue culture plants (fig.1) and handled the same way in the field as a nursery-grown seedling. Cuttings are clean and free of disease and it is similar to a nursery-grown seedling except that these are produced through vegetative means and does not originate from a seed. Rooted cuttings are planted in the field in slightly raised beds to produce seed tubers, which can be further multiplied for two to three seasons before sale to farmers to produce high numbers of seed tubers. Cuttings

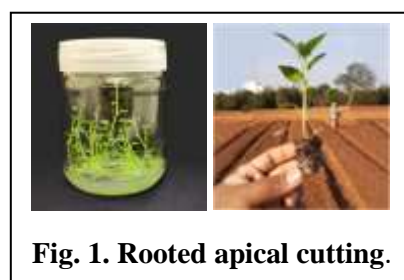


Fig. 1. Rooted apical cutting.

mature quickly in the field, with egg-sized tubers observed 30 to 40 days after planting.

The use of RACs for seed production has immense advantages. One advantage is that RACs can produce larger quantities of seed within the same timeframe compared to other methods. Each RAC has the capacity to produce 10-25 tubers, whereas mini-tubers can only produce 5-10 tubers. As a result, RACs allow for the faster and larger-scale availability of newly released varieties. Additionally, RACs present business opportunities due to the high demand for quality seed in India.

Apical cutting versus stem cutting

Apical cuttings are produced from tissue culture material, where the mother plant is kept young during the production process. This is done to maintain the high productivity potential found in the physiologically young tissue at the simple leaf stage. On the other hand, stem cuttings typically come from mother plants with compound leaves, which are physiologically older. These mother plants usually originate from a tuber and produce compound leaves, from which sprouts and shoots are taken as cuttings. Stem cuttings from mother plants with compound leaves usually result in two tubers per stem.

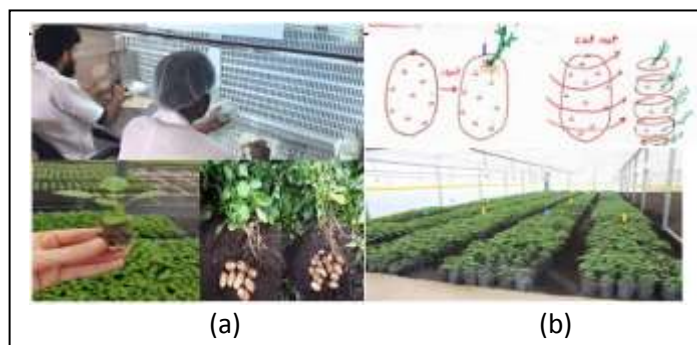


Fig. 2. Apical cutting (a), stem cutting (b)

Steps involved in the production of rooted apical cuttings

Apical cuttings are produced in a screen house from tissue culture plantlets (fig.3). Instead of allowing plantlets to mature and produce mini-tubers, cuttings are produced from the plantlets. Once rooted, the cuttings are transplanted into the field to produce seed tubers (fig.4).



Fig.3. Production of potato tissue culture plantlets in lab.

Advantages of potato seed production through apical stem cuttings.

- Large scale mass multiplication was possible in short period through tissue culture and nursery production under poly-house throughout the year.
- Production of true to type and disease-free plants.
- At very reasonable price planting material can be produced.

- In this technology, flexibility of potato cultivation is possible during both *Kharif* and *Rabi* seasons (May-December).
- Through apical stem cuttings technology, it is possible to avoid market fluctuation for seed tubers during the commencement of season.
- From this technology, timely availability of seed material can be achieved.
- Self-sufficiency of seed material for potato growing states can be achieved.



Fig.4. Planting and management of potato rooted apical cuttings in field

CONCLUSION

Seed production from apical cuttings on farms is a cost-effective method that yields high-quality seed. By using rooted apical cuttings, potato farmers can obtain pathogen-free planting material quickly and affordably. This method can provide better-quality seed than purchased seed and offers an alternative to costly aeroponics technology. By decentralizing potato seed production using this low cost method, seed costs can be reduced by 25-50%. This reduction in costs will greatly benefit small and marginal farmers in potato-growing states by increasing potato yield and ultimately leading to higher profits.

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